

**UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
RENTON, WASHINGTON 98055-4056**

In the matter of the petition of

**BOEING COMMERCIAL AIRPLANE
GROUP**

for an exemption from § 25.809(f)(1) of the
Federal Aviation Regulations

Regulatory Docket No. 27662

PARTIAL GRANT OF EXEMPTION

By letters B-T02T-94-2158, B-T02T-95-0351, B-T02T-95-0383, and B-T02T-95-0428 dated December 22, 1994, March 9, 1995, March 14, 1995, and March 23, 1995, respectively, Mr. K. B. Buchanan, Manager, Certification, B-T02T, 05-02, Everett Division, 747/767 Programs, Boeing Commercial Airplane Group, P.O. Box 3707, Seattle, Washington 98124-2207, petitioned for a reconsideration of the terms of Partial Grant of Exemption No. 5993, in which exemption was denied from the requirements of § 25.809(f)(1) for an escape slide at the entry door on the Model 767-300F freighter airplane carrying supernumerary occupants.

Sections of the FAR affected:

Section 25.809(f)(1), as amended by Amendment 25-34, requires a self-supporting slide, or equivalent, of certain specified characteristics at each passenger emergency exit, to assist occupants in descending to the ground.

Related Sections of the FAR

Section 25.809(f)(2), as amended by Amendment 25-34, requires a rope or other equivalent means of certain characteristics demonstrated to be suitable for the purpose at flightcrew emergency exits, to assist occupants in descending to the ground.

(The above 767-300F certification requirements of § 25.809(f)(1) and (2) are currently found in § 25.810(a)(1) and (2), respectively.)

Section 121.583(a) contains, in pertinent part, a listing of categories of people who may be carried aboard an airplane in part 121 service without complying with all of the passenger-carrying airplane requirements of part 121.

The petitioner's supportive information is as follows:

"Exemption No. 5993 (Regulatory Docket No. 27662) provided a Partial Grant of Exemption to allow the carriage of up to five persons in addition to two crewmembers in the 767-300F flight compartment. The petition for exemption to the escape slide requirements of § 25.809(f)(1) was denied. As provided in § 11.55(a), Boeing requests FAA reconsideration of the denial of grant of exemption to the requirements of § 25.809(f)(1) based on the following:

"1. As specified in § 11.55(d)(1), a petition of reconsideration can be based on a finding of a material fact that is erroneous. In the "FAA's analysis/summary" section of the Partial Grant of Exemption, it appears that the FAA erroneously concluded that since the petition for exemption did not state that the 767-300F entry door had features that differ from the passenger entry door, the 767-300F entry door is the same as the passenger version and therefore an existing escape slide is available for installation. Indeed the 767-300F entry door is different from the passenger entry door, and the FAA was informed of that fact during the January 28, 1993, preliminary type board and specialists meetings which followed.

"Additionally, Issue Paper G-1, Stage 1, dated March 30, 1993, regarding the 767-300F Type Certification basis, specifies the design details concerning the door as follows, 'Replace Type A forward entry door with a simplified Type A door.' Information describing this simplification was discussed during the specialists' meetings, which resulted in the Type Certificate requirements.

"There is no existing escape slide that can be installed on the simplified door. The door, the lift mechanism, the rigid crash barrier, and the movable ceiling panels have been designed for the simplified door system. Additionally, there is no space available in the door entry area to add an escape slide, either existing or new, on the door. An entry door test module is available to demonstrate to the FAA that an escape slide cannot be added to the 767-300F simplified Type A door."

"2. As specified in § 11.55(d)(2), a petition for reconsideration can be based on a departure from, or a ruling contrary to, FAA rules. The FAA denial of the grant of exemption to § 25.809(f)(1) was inconsistent and in conflict with the regulations governing operation (part 121) and those governing airworthiness standards (part 25). Specifically, the FAA denied the grant of exemption based, in part, on the reasoning that supernumeraries are, by default, considered passengers and as such, the escape slide requirements of § 25.809(f)(1) apply. The

inconsistency and conflict exist in that the escape slide is explicitly not required in order to carry supernumeraries under part 121. Section 121.583 contains the operational requirements for the carriage of supernumeraries and paragraph (a) specifically allows non-compliance with § 121.310, which contains the escape slide requirements. Not granting an exemption from a part 25 requirement which does not explicitly apply (due to part 25 not addressing supernumeraries) while a part 121 requirement for carriage of these persons explicitly relieves the escape slide requirement is an inconsistent and conflicting FAA ruling.

"3. As specified in § 11.55(d)(3), a petition for reconsideration can be based on an additional fact relevant to the decision that was not presented in the initial petition for exemption, and the applicant must state the reason the additional fact was not presented in the original petition. The fact concerning the simplified Type A door replacement and the inability to install an existing escape slide is an additional relevant fact, and was not included in the original petition because Boeing assumed the FAA would consider all facts relevant to the petition that had been previously made available to the FAA.

"Another additional fact that is relevant to the decision is the recent effort by Boeing to improve the means of escape provided to the occupants of the 767-300F airplane as a result of additional engineering analysis in response to the public comments. Boeing is proceeding with developing 747-type descent devices for use at the 767-300F Type A door. The 747F upper deck descent devices cannot be used on the 767-300F due to the lower sill height of the 767-300F entry door. A new descent device must be developed, qualified, and certified for use on the 767-300F. Boeing is putting forth our best effort to add descent devices and harnesses on the first 767-300F airplane, scheduled to be delivered in October, 1995. We will keep the FAA informed on our progress. Our goal is to find space to install seven descent devices and seven harnesses. (At least one descent device for each occupiable seat (six) and one harness for each non-crewmember (four) will be installed for use at the simplified Type A door.) Descent devices with harnesses offer an improved level of safety with respect to strength and agility required to evacuate the injured. The reason the descent device and harnesses fact was not presented in the original petition is because the decision to add descent devices and harnesses was made after the original petition was submitted. This improvement should also address most, if not all, of the public comments received by the FAA in response to the original petition."

For the petition of reconsideration, the public interest justification why granting the petition would not adversely affect safety was submitted in the original petition per § 11.25(b)(5), and still apply. Specifically, for reconsideration of exemption from the escape slide requirement of § 25.809(f)(1), the grant of exemption would not adversely affect safety because Boeing is installing inertia reel descent devices at the entry door in lieu of an escape slide (or rope, relative to the original petition). Inertia reel descent devices have been demonstrated by test to be a safe, effective escape means, considering the number and type of persons being requested to be carried onboard a 767-300F airplane. Additionally, the inertia reel descent devices Boeing is installing have also been demonstrated to be effective in assisting the totally incapacitated safely to the ground.

Inertia reel descent devices will now be installed for use at the 767-300F entry door in lieu of an escape slide (or rope, relative to the original petition). Inertia reel descent devices offer an improved means of escape at the 767-300F entry door for crew members and supernumeraries. A summary test report of prototype inertia reel descent device testing follows, and a video tape will be submitted to the Docket.

The following test report and video tape provide a record of prototype 767-300F inertia reel descent device testing recently completed at Boeing. As clarified above, inertia reel descent devices will be installed in the first 767-300F airplane for use at the entry door, in lieu of an escape rope (or slide). The descent devices offer a means of safe evacuation for the able bodied, the injured, and the totally incapacitated.

"Test Report Summary for the
Boeing Model 767-300F Prototype Inertia Reel Descent Device

"Boeing is presently designing and building the new 767-300F freighter airplane. The 767-300F will have the same flight-deck-openable windows and escape ropes as the 767 passenger model aircraft for flight crew evacuation. The 767-300F is configured for carriage of supernumerary personnel. The Boeing petition for reconsideration (of denial of grant of exemption to the escape slide requirement) to allow the carriage of supernumeraries contained a commitment to install 747-style inertia reel descent devices and harnesses at the entry door in lieu of the escape rope.

"The 747-style inertia reel descent device is a simple inertia braking system consisting of a housing with hand grip containing a metal tape coiled about a central axle/brake and attached by means of a cable at the end of the tape to aircraft structure. A person grabs the hand grip and exits the aircraft, and as the tape unwinds, the axle spins and extends the brake as a function of the spin rate, thus slowing the descent. The harness worn by the evacuee includes both vertical and horizontal straps which are tightened about the torso of the evacuee, and a strap with a carabiner which attaches to a fitting in the middle of the descent device hand grip. This arrangement provides a secure means for less able-bodied users of the descent device.

"In January, 1995, Boeing conducted engineering tests to evaluate potential anchor points for the descent devices, and also to try out several methods of using the descent devices. Testing was conducted at the Boeing Everett facility on a test module which simulates the 767 doorway and local fuselage. The module was mounted on a mobile lift, which allowed the door sill height to be adjusted between 6 and 15 feet (minimum and maximum sill heights). Prototype descent devices from the supplier were attached to anchor points on the forward side of the door at locations representative of those under consideration, primarily at ceiling height and waist height. The test assessed the usability of the harness with the device when installed on the 767-300F, and its effectiveness for evacuating incapacitated persons. Test subjects demonstrated variations of how an evacuee would use the descent device and harness for egress from the

767-300F entry door. For example, in some trials the test subjects sat on the door sill and then pushed off with their leg or feet. In other trials, the subjects stepped out, rappelled, or jumped out of the doorway. Ease of use and test subject confidence were evaluated for each trial. The tests evaluated the effectiveness of the anchor point and egress methods for evacuees ranging from 5th percentile (by weight) females through 95th percentile (by weight) males.

"Safety practices included positioning large pillows, and assistants acting as "spotters" beneath the module where the test subjects were expected to land. Also for safety reasons, the test subjects were fitted with helmets, and a one-inch-thick sheet of Ensolite foam was taped to the fuselage below the door sill.

"Testing was successfully completed. The results and findings were as follows:

"The prototype descent devices were shown to be effective in providing egress capability for a wide range of adult human sizes and weights. It took from one to two seconds for the test subjects to descend from the 15-foot maximum sill height. All test subjects were well able to land on their feet, and commented favorably on the degree of stability and control experienced during the descent and landing. Anchor points above shoulder height were shown to be the most effective, as they allow the evacuee to egress from either a standing or sitting position with ease and confidence. The harness was compatible with use of the descent device at the 767-300F entry door. Attaching the harness to the descent device provided an additional sense of security for those who questioned their ability to maintain a grip on the descent device handle.

"The harness and descent device provided a safe evacuation means for a 95th percentile male simulating unconsciousness. The test subject's harness was clipped onto the descent device, and the subject was then gently pushed out of the doorway and lowered to the ground by the descent device and harness in a natural attitude. (Run #22 on video tape.)

"Egress was safely accomplished from either a standing or sitting position. Although either method is acceptable, standing is preferred as providing the more rapid evacuation. Stepping, rather than jumping, out of the doorway is also preferred because the evacuee maintains a higher degree of control during the descent. None of the test subjects swung underneath the door sill to the point of their body contacting the fuselage. Although not instructed to do so, all test subjects used the same two-handed grip on the descent device handle, and all attempted to rotate so as to face the fuselage during the descent. The descent rate was slower for the lighter person (approximately two seconds rather than one). At the minimum sill height of 6 feet, the descent devices do not noticeably slow the evacuee's rate of descent. The descent devices were successfully used by two of the test subjects without using the harnesses. (Test runs #23 and 24 on video tape.)

"In conclusion, the testing showed that the prototype descent device, used with or without the harnesses, provides an effective means of assisting evacuees safely to the ground from a 767-300F entry door. The device with the harness can be used for safely evacuating an

incapacitated or unconscious person. The device is a most effective assist means with a ceiling height anchor point and when used by stepping out of the doorway.

"The video tape includes eight of the 767-300F prototype inertia reel descent device test runs. These test runs were typical of the testing, and are intended to provide a brief overview of inertia reel use as described by this test report summary. Four examples of the preferred egress method (standing) are shown first. A view of the alternate, sitting egress method follows. Next, we have shown the two tests conducted without harnesses. The test simulating evacuation of a totally incapacitated person concludes the overview.

View	Test Run	Description
1	4	Jeff Standing [95th % (by weight) male]
2	11	Diane Standing [70th % (by weight) female]
3	12	Fern Standing [5th % (by weight) female]
4	13	Jeff Standing
5	1	Diane Sitting
6	23	Diane Standing - no harness
7	24	Jeff Standing - no harness
8	22	Jeff Incapacitated

Note: Anchor point 1 was located approximately 82 inches above the aircraft floor.
Anchor point 2 was located approximately 74 inches above the aircraft floor."

"The principal reason why the 767 passenger door with slide cannot be installed on the Model 767-300F airplane is the door could not be opened more than approximately 35% due to a hard interference between the passenger door linings and the side rigid barrier and door 9g crash protection structure. Additionally, sufficient space would not exist to safely operate the 767 passenger door with slide installed. The 767 passenger door with escape slide opens rapidly and automatically in an emergency after rotation of the interior handle. The automatically opening door would trap the person between the side rigid barrier and the door linings, tending to compress and crush the person's chest and head. Serious injury would occur without sufficient space for the person to back away from the automatically opening door."

With reference to observations that there appears to be considerable space adjacent to the door, to add an escape slide, sufficient space is indeed available but only when the door is

closed. Sufficient space is not available to add an escape slide on the door and be able to fully open it.

"The 767-300F simplified door with close contour linings was necessary to achieve the most forward cargo container/pallet position on the airplane. Boeing's ability in providing the most forward position has been instrumental in our customers' decisions to purchase the 767300F. It is needed for the model to be profitable in commercial service.

"In order to install the 767 passenger door with slide on the 767-300F and operate the door safely, the most forward cargo container/pallet position would have to be sacrificed and the airplane economics would be negatively impacted. Notwithstanding that fact, the following would be the scope of effort required:

- "1. Design, fabricate, and install a new side rigid barrier (with new support to airframe structure) at a location approximately 2 feet inboard.
2. Redesign, fabricate, and install the main (fwd) and aft barriers to accommodate the new side barrier location.
3. Redesign, fabricate, and install the 767-300F door counterbalance for the additional weight of the slide on the door.
4. Redesign the cargo handling system to eliminate the most forward container position.
5. Redesign, fabricate, and install the overhead air distribution system to accommodate the new side barrier location.
6. Redesign, fabricate, and install a modified cargo compartment smoke detection system.
7. Redesign and install a modified galley that accommodates the new side barrier location.
8. Redesign, fabricate, and install new floor panels and floor coverings in the door entryway area.
9. Redesign, fabricate, and install modified cargo compartment linings in the area of the new side barrier location.
10. Redesign, fabricate, and install new ceiling and doorway linings that accommodate the new side barrier location.
11. Redesign, fabricate, and install modified floor structure in the area of the new side barrier location.
12. Redesign, fabricate, and install modified section 41 monocoque to accommodate the new side barrier location.
13. Redesign, fabricate, and install a modified galley vent system that accommodates the new side barrier location.
14. Redesign, fabricate, and install the 767-300F entry door 9g crash protection structure to accommodate the 767 passenger door with slide.
15. Redesign, fabricate, and install a modified arm/disarm mechanism that meet customers' requirements.
16. Scrap existing tools and parts.
17. Design and fabricate new assembly and installation tools.
18. Rework existing parts to allow their use in the new configuration.

19. Rework existing maintenance instruction documents and cargo loading manual.

"The 767-300F development program is drawing to a completion. The first airplane rolls out of the factory on May 5, 1995, and delivers to UPS in October, 1995. The modifications listed above represent a substantial change to the configuration and would cause a severe delay in airplane deliveries to the airline operators and a severe economic impact to The Boeing Company and the operators. The modifications listed above would take approximately two years to accomplish and would cause seventeen 767-300F airplane deliveries to be delayed until approximately April 1997."

A summary of Boeing's petition for reconsideration was published in the Federal Register on February 17, 1995 (60 FR 9423). Two comments were received.

One commenter, an intended operator of the 767-300F airplane, takes the position that the inertia reel device and harness system that is currently proposed by Boeing in lieu of either a rope (originally proposed by Boeing) or a slide (mandated by Exemption No. 5993) at the crew entry door, is the preferable option, and offers a level of safety equal to or higher than that of a slide for this application. The summarized points offered by this commenter in support of this conclusion include: (1) The likely reliability of the relatively simple mechanical inertia reel devices should be superior to complex, sophisticated slides, which have a history of service bulletins and airworthiness directives issued against them; (2) Inertia reels would provide superior availability and usability under conditions of certain unusual attitudes or terrain or crash debris that may make successful slide deployment dubious; (3) Slide failure would adversely affect all occupants, whereas an inertia reel failure would likely affect only a single reel and leave the remaining reels able to accommodate all occupants, and ; (4) The prototype inertia reels for this installation have been demonstrated to accommodate the safe, controlled evacuation of injured occupants, whereas slides allow only an uncontrolled sliding descent of evacuees.

The other commenter, representing affected pilots, offers the opinion that slides are the proven, best, and safest means of escape for any category of occupant, and provides a detailed defense of the FAA's position and decision documented in Exemption No. 5993. This commenter, in addition, particularly objects that Boeing failed to follow the prescribed course of action in seeking the desired exemptions prior to committing to the affected design, and further faults Boeing for attempting to justify the exemption sought by the excuse of them being already expensively committed to the design in question. This commenter, although preferring slides, nevertheless addressed the possibility of the FAA allowing inertia reels in lieu of a slide, and suggested several conditions which they felt should be imposed as part of that approval. These summarized conditions included: (1) clarifying that an inertia reel device and harness would be available to each occupant, on all delivered affected aircraft; (2) accomplishing a full-scale emergency evacuation demonstration; and (3) providing for initial and recurrent training.

The FAA's analysis/summary is as follows:

The FAA is convinced, first, that the petitioner has satisfactorily substantiated that the proposed cargo carrying capability of the 767-300F airplane necessitates an interior configuration that

physically precludes retaining the existing 767 passenger airplane's passenger entry door with escape slide. It is further convinced that a very substantial and expensive effort would be required to reconfigure and develop an alternate entry that would both accommodate an escape slide and allow the proposed cargo carrying capability. The FAA is also convinced that reconfiguring the proposed configuration for a reduced cargo carrying capability in order to accommodate the original 767 door and escape slide would represent a significant hardship to both the petitioner and all of its prospective customers. The FAA is satisfied that there is a legitimate public interest by the manufacturer, operators, and shipping customers, in allowing the proposed increased cargo carrying capability.

Notwithstanding the difficulties associated with any changes to the proposed design, or the anticipated benefits of allowing the proposed design to stand, exemption from the subject requirement would not be permitted without assuring that the exemption would not adversely affect safety or would not provide an equivalent level of safety. Toward that end, the petitioner's initial proposal to utilize an escape rope for this application, in lieu of an escape slide, was denied in Exemption No. 5993. The current proposal, with accompanying video tape of an informal demonstration, for an inertial reel and harness means of emergency egress has been carefully reviewed in light of the comments received. The FAA has consequently concluded, provided certain conditions defined below are observed, that inertial reels and harnesses for a limited application of this nature can provide at least an equal level of safety to that provided by escape slides.

In consideration of the foregoing, I find that a partial grant of exemption is in the public interest and will not affect the level of safety provided by the regulations. Therefore, pursuant to the authority contained in §§ 313(a) and 601(c) of the Federal Aviation Act of 1958, delegated to me by the Administrator (14 CFR 11.53), Boeing Commercial Airplane Group is hereby granted an exemption from § 25.809(f)(1) of the Federal Aviation Regulations. The petition is granted to the extent required to permit type certification of the Boeing model 767-300F freighter airplane with provisions for the carriage of persons other than flight crewmembers, with the following conditions:

1. In lieu of an escape slide, the emergency evacuation assist means at the entry door shall be an inertia reel descent device and harness provided for each occupant.
2. The intended inertia reels and harnesses must be demonstrated, in accordance with an FAA-approved test plan, to be suitable for the purpose by a full-scale emergency evacuation demonstration utilizing the maximum number of occupants allowed by approved seating. This demonstration should include the satisfactory evacuation of incapacitated occupants. The demonstration must be found to be acceptable by the FAA.
3. The procedures found to be acceptable during the emergency evacuation demonstration shall be those that are incorporated into approved operator's procedures. Any deviations from this condition require a fully coordinated FAA approval.

4. Flightcrew shall receive initial and recurrent training using the assist means provided and the approved procedures.

5. The airplane flight manual must contain a limitation that maximum occupancy is restricted by Condition numbers 1 and 2 above (not to exceed 7).

Other provisions of Exemption No. 5993, together with its conditions and limitations, remain the same and are applicable to this exemption. This amendment is part of, and shall remain attached to, Exemption No. 5993.

Issued in Renton, Washington, on

Stewart R. Miller
Acting Manager
Transport Airplane Directorate
Aircraft Certification Service, ANM-100